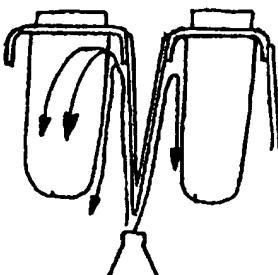


PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>A23G 9/26</b>		A1	(11) International Publication Number: <b>WO 98/00030</b> (43) International Publication Date: <b>8 January 1998 (08.01.98)</b>
(21) International Application Number: <b>PCT/DK97/00281</b> (22) International Filing Date: <b>30 June 1997 (30.06.97)</b>  (30) Priority Data: <b>0708/96 28 June 1996 (28.06.96) DK</b>		(81) Designated States: <b>AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</b>	
(71) Applicant (for all designated States except US): <b>TETRA PAK HOYER A/S [DK/DK]; Søren Nymarks Vej 13, DK-8270 Højbjerg (DK).</b> (72) Inventor; and (75) Inventor/Applicant (for US only): <b>WALDSTRØM, Ejvind [DK/DK]; Ternevej 33, DK-8240 Risskov (DK).</b> (74) Agent: <b>K. SKOTT-JENSEN, PATENTINGENØRER A/S; Lemmingvej 225, DK-8361 Hasselager (DK).</b>		Published <i>With international search report. In English translation (filed in Danish).</i>	
(54) Title: <b>A METHOD AND AN APPARATUS FOR PRODUCTION OF FROZEN CONFECTIONERY, IN PARTICULAR EDIBLE ICE BODIES</b>			
			
(57) Abstract			
<p>Conventionally, edible ice bodies are frozen in freezing moulds that are moved through a bath of cold salt brine, which ensures a good freezing effect, but also presents obvious problems. For avoiding these problems it has already been endeavoured to use cold air instead, but so far without noticeable practical success. The invention provides for an efficient and economical freezing by cold air, viz. in suggesting that the transverse carrier lamella plates (2) for rows of aluminium moulds (8) in an endless lamella conveyor are advanced stepwise into positions, in which cold air from underlying slot nozzles (46) is blown up into the spaces between the rows of moulds in a manner effectively shielded from the surroundings.</p>			

BEST AVAILABLE COPY

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		

A method and an apparatus for production of frozen confectionery, in particular edible ice bodies.

5 The present invention relates to a method and an apparatus for production of edible ice bodies by moulding and freezing the bodies in singular moulds.

For such a production with high capacity it is customary that the moulds, in transversely arranged rows, are 10 advanced in a conveying line which can be rectilinear or annular in a horizontal plane, the moulds during this conveying being depending into a freezing brine, which ensures a good heat transfer. The moulds are initially filled with a cold ice substance, and in a following station, in 15 which the ice has started to solidify, carrier sticks are inserted in the products, whereafter a final freezing is effected along a freezing stretch. At the end thereof the rows of moulds are successively lifted and transferred to a bath of warm water for a brief heating of the mould walls in 20 order to loosen the adherence of the ice bodies to the moulds, whereafter the upwardly protruding carrier sticks of the products are gripped by a gripping equipment operating to pull the products upwardly and transfer them to further 25 conveying to a packing or working station, e.g. for applying a coating and, optionally, a withdrawal of the carrier sticks in cases where these should not remain on the products.

The use of the freezing brine, which is a strong salt solution, involves a number of problems, partly because it is indeed not a food grade substance and partly because it is 30 heavily corrosive, whereby the moulds and other relevant parts of the apparatus should be made of corrosion resistive materials.

It has previously been recognized that these problems may be overcome by cooling the moulds with cold air instead 35 of brine, but the production systems of this type as disclosed so far have been tremendously energy consuming, with a poor efficiency of the freezing air and even with a non-uniform freezing action on the moulds.

It is the purpose of the present invention to provide a method and an apparatus which enables an air freezing of the moulds with a high efficiency.

According to the invention the transverse rows of moulds, which are mounted depending from transverse carrier plates forming a carrier belt, are advanced stepwise into positions above intermediate areas between underlying, likewise transverse slit nozzles, through which freezing air is blown up against the underside of the carrier belt into the interspaces between the mould rows. It has been found possible to thereby achieve a very efficient air sweeping of the moulds, as the air, in an unobstructed and forceful manner, may be blown up to the carrier belt and be reflected therefrom so as to flow down along the walls of the moulds right from the upper ends thereof.

In an apparatus according to the invention, cf. claim 2, it is advantageous to use depending, flexible and slightly protruding skirt plates at the opposite edges of the carrier plates (claim 3). When these skirt plates meet each other at their lower ends, they will form a depending wedge formation between the neighbouring mould rows, whereby the upwardly directed air flow will be cleaved and guided up to a concentrated impact against the mould walls, whereby an effective heat transfer is obtainable. Moreover, the skirt plates will provide a sealing or shielding effect towards the surroundings, also if changes occur in the mutual distance between the carrier plates, in particular in connection with a sprocketing between a forward run and a return run of the belt formed by the carrier plates, such that no noticeable amount of cold air can escape from the space underneath the moulds.

With the use of an upper forward run and an underlying return run of the said carrier belt it is perfectly possible to expose even the moulds in the lower run to an effective freezing. In this run the moulds face downwardly, but when the ice substance in the upper run has reached such a degree of freezing that the ice bodies adhere to the moulds, then the same bodies will be fully self-

holding in the moulds also when these are turned upside down. When thus also the return run can be used for the freezing of the bodies this may imply a minimizing of the total length of the conveyor, which is of course important for both the space 5 requirements and the apparatus costs.

In the following the invention is described in more detail with reference to the drawing, in which:

Fig. 1 is a perspective view of a number of mould carrying lamella plates in an apparatus according to the 10 invention;

Fig. 2 is a corresponding view of a single mould therein;

Fig. 3 is a lateral view of the entire apparatus;

Fig. 4 is an end view thereof;

15 Figs. 5-7 are interconnected plan views of an air distribution system in the apparatus;

Fig. 8 is a side view illustrating the action of the freezing air against the moulds; and

20 Figs. 9-11 are plan views corresponding to Figs. 5-7 of a modified system.

Fig. 1 illustrates a few carrier plates in a row of such plates forming a conveyor belt driven by conveyor chains, the plates 2 being advanced with rollers 4 in engagement with guiding rails 6. Each plate has a row of 25 holes in which there are mounted depending moulds 8 made of aluminium. At their upper ends the moulds are provided with a shoulder portion 10 and with a neck portion 12 projecting upwardly therefrom so as to fit in the plate hole and having a ring groove 14 at the corners for receiving a locking ring 30 16. Hereby the moulds can be fixed to the plates in a sufficiently rigid and tight manner. The moulds may be provided with cooling ribs-18.

The carrier plates 2 are provided with depending skirt plates 20 seeking to pivot resiliently outwardly, 35 whereby they are pressed together at their lower ends so as to seal the slot between the carrier plates.

The entire conveyor is shown in Fig. 3, where the said conveyor belt is designated 22. This belt, with both its

upper run and its lower return run, is passed through an air cooling zone 24 with interior cooling and circulation of freezing air. The projecting end portions of the conveyor are sealed with non-illustrated side panels, and from the 5 inserted partial view it will be seen that the skirt plates 20 maintain their sealing action during the passage of the belt around the relevant sprocket wheels 28. The top of the freezing tunnel 24 is closed with a lid 30 which, however, may have an opening at a stick insertion station somewhat 10 inside the end of the tunnel at which the moulds are filled, this not being further illustrated.

In Figs. 3 and 4 it is indicated that the air system comprises a row of laterally oriented fans 32 forcing air through lower cooler elements 34, from which the cold air 15 flows through a side compartment 36 up to a distributor chamber 38 between the upper and the lower run of the conveyor 22. This chamber is described in more detail below. The air is sucked off from the chamber to the fan 32 through an opposite side compartment 40.

20 The walls of the tunnel are well heat insulated, and they are made as sections that can be individually removed, e.g. in being swung upwardly as shown in dotted lines.

In the chamber 38, as shown in Figs. 5-7, there is arranged a system of guide plates with bottom portions 42 25 which, from an inlet opening A in the left hand side, extends upwardly inclined and also in a narrowing manner towards the opposite side. The side edges of these bottom plates 42 have upstanding wall portions 44 which, in an inclined and narrowing manner, extend upwardly so as to form a narrow slit 30 46 all over the width of the belt 22 and immediately beneath the the moulds 8. Between the single units 42,44,46 there is a free space 48 which is in open connection with the outlet to the suction chamber 40.

In operation, the belt 22 is advanced stepwise into 35 positions as shown in Figs. 7 and 8, i.e. with the carrier plates 2 in positions, in which the meeting ends of the skirt plates 20 of every second set of neighbouring plates are located just above the slits 46. With the disclosed design of

the system the cold and strong air flow from the split 46 - as illustrated in Fig. 8 - will be cleaved by the skirt plates 20 and with noticeable turbulence be forced upwardly along these plates to their upper ends, from which the air is 5 effectively distributed about the moulds . Thereafter the air may more calmly flow further to the space 48 and still further through a wide channel path to the fan.

In Figs. 9-11 another and preferred design of the distributor system according to Figs. 5-7 is illustrated. 10 Here, the bottom portions 42' are oppositely inclined, and the wall portions 44' are arranged as triangular, vertical side walls located such that in an alternating manner they form narrow, upwardly open slit chambers 46' and broader intermediate spaces 49, which at the bottom are closed by the 15 bottom plates 42' and, besides, are open towards the discharge side. The inlet air flows up through the slit chambers 46', also here directly up against the meeting edges of the skirt plates 20, whereafter the air can flow off to the outlet side with reduced velocity through the broader 20 intermediate space 49. In particular this design of the system has been found to be very advantageous in practice.

In this way it has been found possible to achieve such an efficient utilisation of the freezing air that the system may operate with good economy and capacity.

25 It will be possible to let the products remain in the moulds while these are moved along a stretch of the lower run, where they will still be exposed to the cold air. The products will be self-holding in the inverted moulds, and by such an exploitation of the return run it will be possible to 30 reduce the overall length of the apparatus. If the thawing release and demoulding of the products is arranged at the end of the return run, the moulds will be easy to keep clean for possible knocked off product fragments, as these will then fall out by themselves.

35 According to the invention the required release thawing may well take place inside the cold space, viz. in that a 'heat box' is brought to move up or down for communication with the moulds of the single carrier plates.

Use can be made of any suitable heating source which may more or less rapidly operate to effect a release of the products by heating through the walls of the aluminium moulds.

## C L A I M S :

1. A method of producing edible ice bodies by moulding and freezing in individual moulds and with the use of cold air as freezing medium, the moulds being advanced rowwise, depending from a carrier belt preferably made of lamellar carrier plates, from a filling station through a freezing zone to a demoulding station, characterized in that the advanced, crosswise oriented rows of moulds are moved stepwise into positions above middle areas between underlying, likewise crosswise oriented nozzle slits, through which freezing air is blown up against the underside of the carrier belt in the interspaces between respective neighbouring pairs of the rows of moulds.
- 15 2. An apparatus for production of edible ice bodies by the method claimed in claim 1, comprising a carrier belt made of juxtaposed lamellar carrier plates each carrying a row of depending moulding and freezing moulds for advancing these moulds through a freezing zone, in which they are exposed to blown-on freezing air, characterized in that the means for effecting the on-blowing of the freezing air comprise crosswise oriented nozzle slits or nozzle rows arranged with a mutual spacing corresponding to the distance between the mould rows or a whole multiple thereof, and that the driving means for the carrier belt are preferably operable to advance the belt stepwise to such positions, in which the rows of moulds are located next to the interspaces between the nozzle slits or rows.
- 30 3. An apparatus according to claim 2, characterised in that the carrier plates, along their interfacing edges, are provided with depending skirt plates, which are resiliently outwardly pivotable or coupled together in such a manner that these plates in each pair of meeting skirt plates provide sealing therebetween in spite of possible distance variations between the carrier plates, whereas the driving means of the carrier belt operate to advance the belt stepwise in such a manner that the meeting lower edges of the skirt plates by relevant advancing steps are brought to

positions just above respective underlying, transverse nozzle slits or rows.

4. An apparatus according to claim 2, characterized in that the nozzle slits are formed by means of an air box system which, at one side of the carrier belt, receives freezing air from a transversely oriented blower/air cooler system for channelling this air to the respective air slits, while the same air box system, in the areas between the nozzle slits, have partial sections for receiving return freezing air from the outsides of the freezing moulds and for guiding this air to an air intake area for the blower/air cooler system located at the opposite side of the carrier belt.

5. An apparatus according to claim 4, characterized in that the air box system is mounted in the interspace between an upper forward run and a lower return run of the carrier belt in such a manner that the freezing air is additionally brought into contact with the moulds of the lower return run of the belt.

6. An apparatus according to claim 4, characterized in that the air box system has intake openings directly to narrow, mutually separated box compartments having upper openings forming the said nozzle slits, while between these compartments there are return box compartments which, at their top sides, receive the freezing air returned from the moulds and guide this air to the outlet opening, i.e. to the said air intake opening of the blower/air cooler system, said return air compartments having bottom plates which, from a high level position at the said inlet openings, are downwardly inclined towards the lower edge of the respective outlet openings.

7. An apparatus according to claim 2, characterized in that the moulds are made of aluminium with outstanding rib portions.

8. An apparatus according to claim 7, characterized in that the moulds are made with an exteriorly narrowed neck portion that fits into a receiving hole in the carrier plate

and is provided with circumferential groove portions for reception of a locking ring above the carrier plate.

9. An apparatus according to claim 2, characterized in that the carrier belt extends as a conveyor belt with an upper forward run, in which the moulds cooperate with the said nozzle slits or rows, and an underlying return run, in which the moulds are moved with their mouthings facing downwardly and so as to be upwardly projecting into an air space in open connection with the freezing air space, from which the moulds in the upper run are subjected to the freezing air.

10. An apparatus according to claim 9, characterized in that the associated means for cooling and blowing of the freezing air are provided underneath the lower conveyor run for provision of a crosswise directed air flow, which is circulated across the carrier conveyor in an opposite transverse direction, respective upwardly and downwardly air guiding connector channels being arranged at the opposite sides behind respective openable side wall portions.

Fig.1

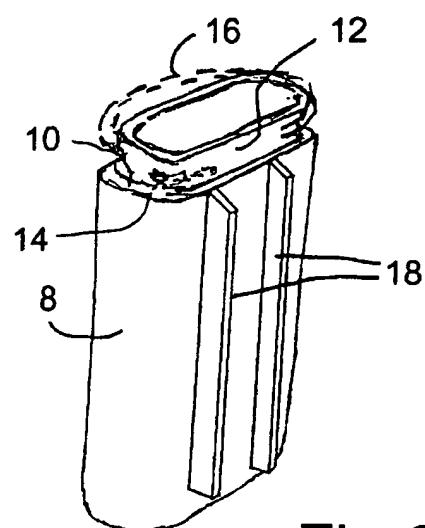
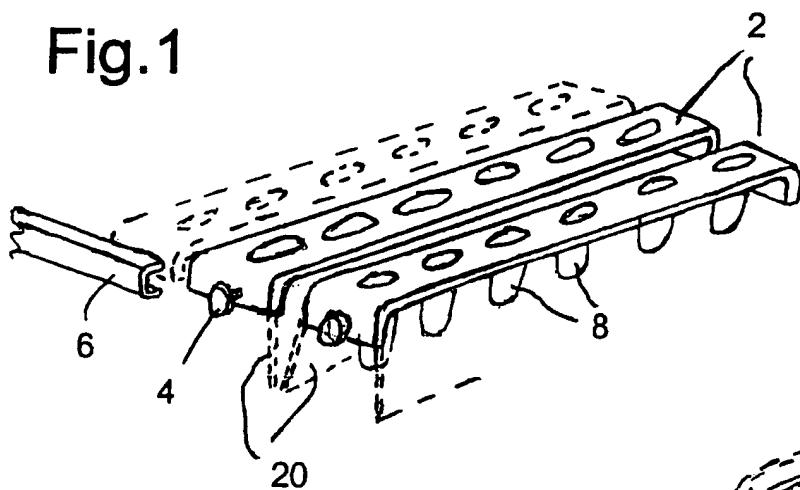


Fig.2

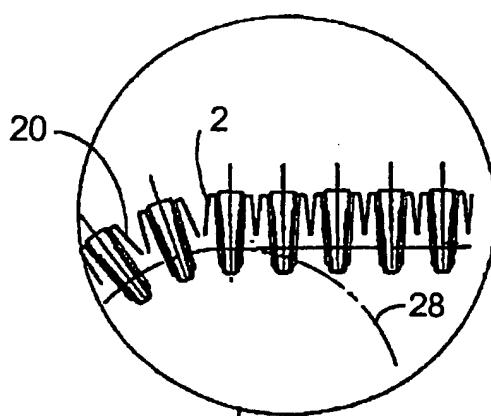
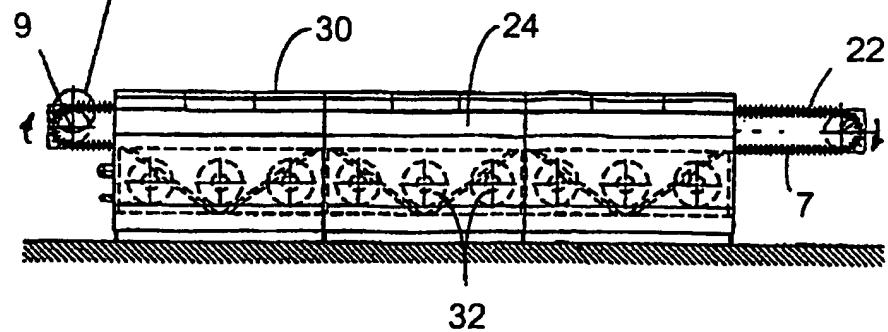


Fig.3



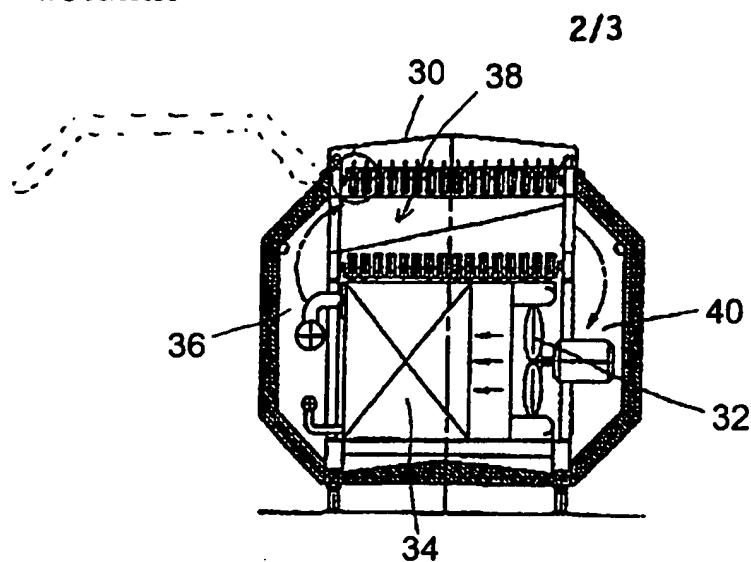


Fig.4

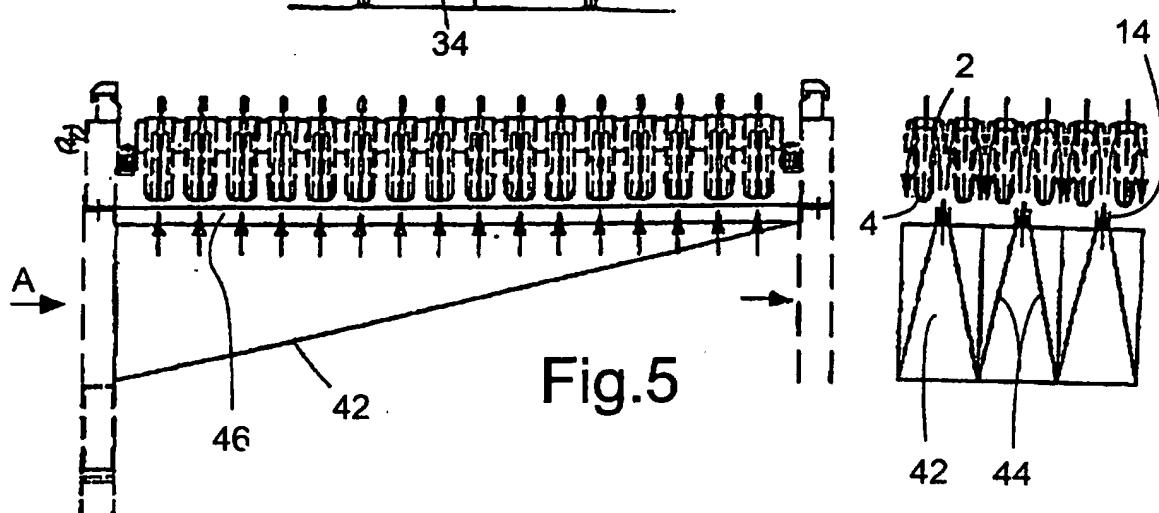


Fig.5

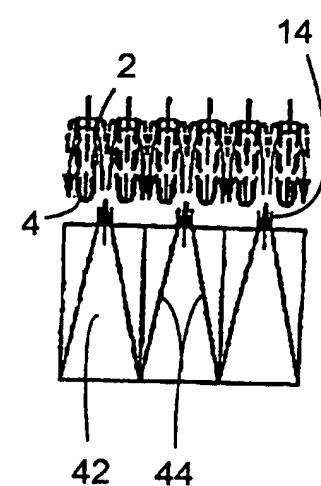


Fig.7

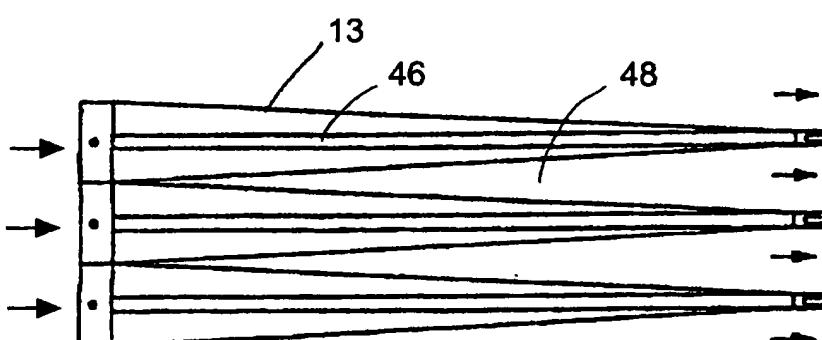


Fig.6

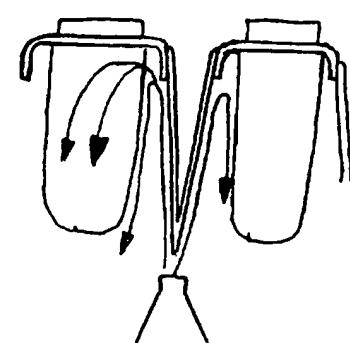


Fig.8

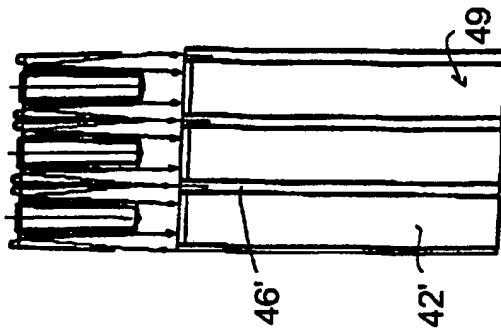


Fig.11

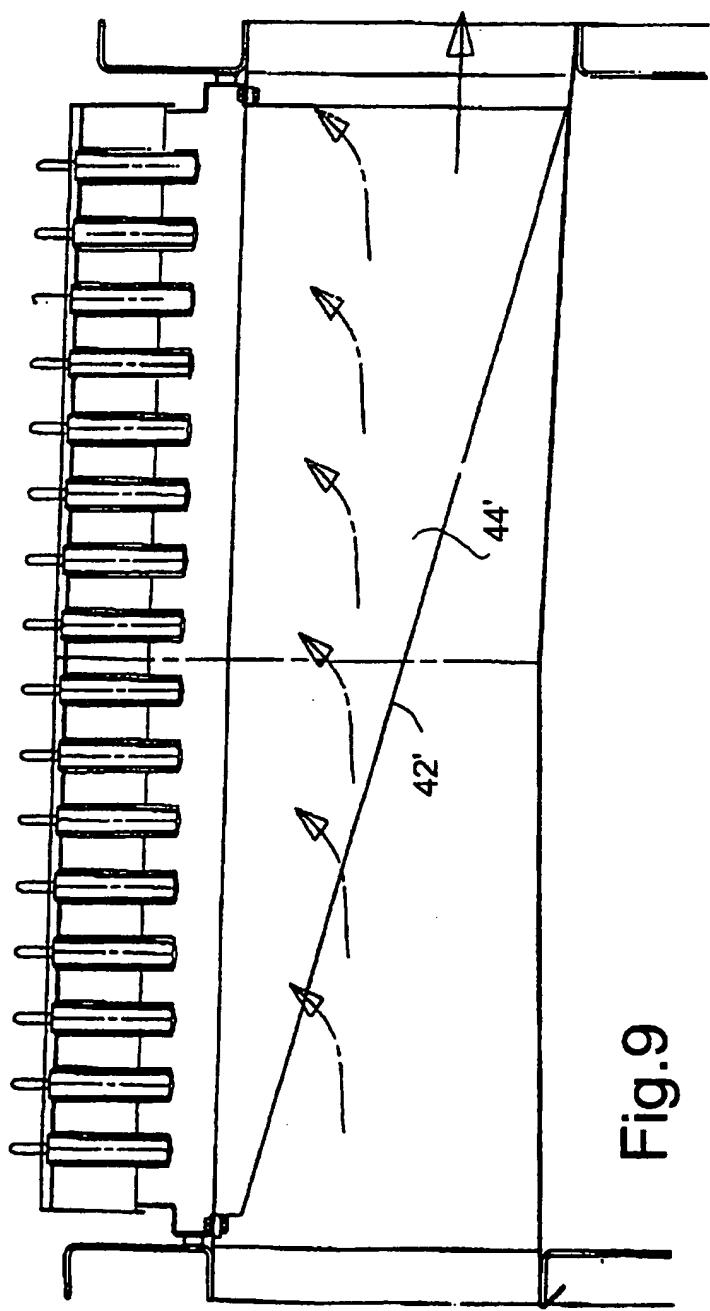


Fig.9

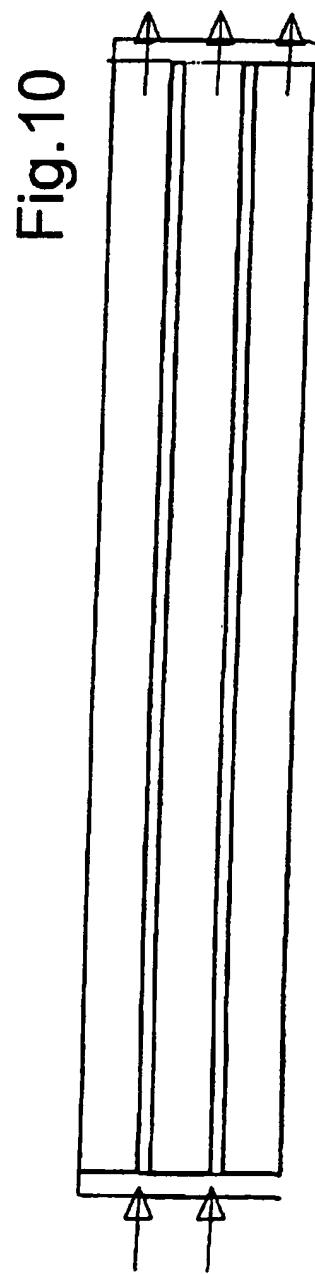


Fig.10

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/DK 97/00281

A. CLASSIFICATION OF SUBJECT MATTER		
<b>IPC6: A23G 9/26</b> According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
<b>IPC6: A23G</b> Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched <b>SE,DK,FI,NO classes as above</b>		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
<b>DIALOG: ALLSCIENCE</b>		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4335583 A (RONALD J. BILLETT), 22 June 1982 (22.06.82), column 2, line 21 - line 41; column 8, line 45 - line 66, figures 8-12	1,2
A	---	3-10
Y	US 4715193 A (CARLO CURTI), 29 December 1987 (29.12.87), figures 1-3, abstract	1,2
A	---	3-10
	-----	
<input type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "B" earlier document but published on or after the international filing date "C" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "D" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search  <b>8 October 1997</b>		Date of mailing of the international search report  <b>13-10-1997</b>
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer  <b>Wiva Asplund</b> Telephone No. +46 8 782 25 00

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

01/09/97

International application No.

PCT/DK 97/00281

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4335583 A	22/06/82	AU 6891481 A BR 8102718 A CA 1145575 A EP 0039513 A,B JP 1349244 C JP 57002642 A JP 61013782 B	12/11/81 26/01/82 03/05/83 11/11/81 28/11/86 08/01/82 15/04/86
US 4715193 A	29/12/87	DE 3603338 A DK 55386 A GB 2170892 A,B	07/08/86 07/08/86 13/08/86

This Page is inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT OR DRAWING
- BLURED OR ILLEGIBLE TEXT OR DRAWING
- SKEWED/SLANTED IMAGES
- COLORED OR BLACK AND WHITE PHOTOGRAPHS
- GRAY SCALE DOCUMENTS
- LINES OR MARKS ON ORIGINAL DOCUMENT
- REPERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**  
As rescanning documents *will not* correct images  
problems checked, please do not report the  
problems to the IFW Image Problem Mailbox